

WHAT IS CLAIMED IS:

1 1. In a communication network having a plurality of communication units, a
2 communication unit that transmits messages to and receives messages from neighboring
3 communication units, the communication unit comprising:

4 a transmitter to transmit an outgoing message to a neighboring communication unit;
5 a receiver to receive an incoming message from a neighboring communication unit;
6 a storage unit to store communication unit connectivity information, neighboring
7 communication unit connectivity information and merge request information; and
8 a processor to control said transmission of outgoing messages and reception of incoming
9 messages, wherein said processor includes:

10 a merge module to examine said stored connectivity information and stored
11 merge request information to determine merge control parameters to control merger
12 between the communication unit and a neighboring communication network; and
13 a controller module to control merging of the communication unit with said
14 neighboring communication network in accordance with said merge control parameters
15 determined by said merge module.

1 2. The communication unit of claim 1 wherein said transmitter transmits said
2 outgoing message in the form of radio signals.

1 3. The communication unit of claim 1 wherein said receiver receives said incoming
2 message in the form of radio signals.

1 4. The communication unit of claim 1 wherein said processor further includes:
2 a synchronization module to determine a Time Of Day synchronization mode used by the
3 communication unit.

1 5. The communication unit of claim 4 wherein the synchronization module further
2 includes:
3 a startup module to join the communication unit to an existing communication network at

4 power up using a user configurable primary Time Of Day synchronization mode.

1 6. The communication unit of claim 5 wherein the synchronization module further
2 includes:

3 a Time Of Day mode module to change the Time Of Day synchronization mode of the
4 communication unit in response to the communication unit failing to join a communication
5 network with neighboring communication units using a previously selected Time Of Day
6 synchronization mode and to join the communication unit to an existing communication network
7 using the changed Time Of Day synchronization mode.

1 7. The communication unit of claim 6 wherein the synchronization module further
2 includes:

3 a network start module to start an isolated network with neighboring communication
4 nodes upon failing to join a communication network with previously selected Time Of Day
5 synchronization modes.

1 8. The communication unit of claim 1 wherein said storage unit further includes:
2 a connectivity module to store at least one of an identifier for a communication network to which
3 the communication unit belongs, an identifier for a neighboring communication unit, an identifier
4 for a communication network to which a neighboring communication unit belongs, and an
5 identifier for a neighboring communication unit's neighbor.

1 9. The communication unit of claim 1 wherein said processor further includes:
2 a search module to determine search parameters that control the manner in which the
3 communication unit searches for neighboring communication units and neighboring
4 communication network nodes;

5 wherein the controller module further controls transmission of outgoing messages and
6 reception of incoming messages in a manner consistent with search parameters determined by the
7 search module.

1 10. The communication unit of claim 9 wherein said search module further includes:

2 a transmit rate module to determine a rate at which the communication unit transmits
3 outgoing messages containing network connectivity information.

1 11. The communication unit of claim 10 wherein the transmit rate module determines
2 the transmit rate based upon a user configurable reference transmit rate value and a percentage of
3 network size parameter value for the communication network to which the communication unit
4 belongs.

1 12. The communication unit of claim 11 wherein the transmit rate is proportional to
2 the percentage of network size parameter value.

1 13. The communication unit of claim 9 wherein said search module further includes:
2 a scan window module to determine a scan window interval during which the
3 communication unit receives incoming network connectivity messages; and
4 a scan window delay module to determine a delay between scan window intervals.

1 14. The communication unit of claim 13 wherein the scan window module determines
2 the scan window interval based upon a user configurable reference scan window value and a
3 percentage of network size parameter value for the communication network to which the
4 communication unit belongs.

1 15. The communication unit of claim 14 wherein the scan window interval is
2 inversely proportional to the percentage of network size parameter value.

1 16. The communication unit of claim 1 wherein said merge module further includes:
2 a merge priority module to determine a merge priority for each neighboring
3 communication network in response to the communication unit controlling said merging,
4 wherein the merge priority controls the priority in which the communication unit allows the
5 communication network to which the communication unit belongs to merge with neighboring
6 communication networks.

1 17. The communication unit of claim 16 wherein the merge priority module
2 determines the merge priority for a neighboring communication network based upon a
3 comparison of a number of active communication units in the neighboring communication
4 network with a number of total communication units in the neighboring communication network.

1 18. The communication unit of claim 17 wherein the merge priority is proportional to
2 a quotient of the number of active communication units and the number of total communication
3 units for each respective neighboring network.

1 19. In a communication network having a plurality of communication units that
2 transmit messages to and receive messages from neighboring communication units, a method for
3 establishing communication between the plurality of communication units comprising:

4 (a) storing communication unit connectivity information, neighboring communication
5 unit connectivity information and merge request information within a communication unit;

6 (b) examining said stored connectivity information and stored merge request information
7 to determine merge control parameters to control merger between the communication unit and a
8 neighboring communication network; and

9 (c) controlling merging of the communication unit with a neighboring communication
10 network in accordance with said merge control parameters.

1 20. The method of claim 19, wherein communications within said communication
2 network are in the form of radio signals.

1 21. The method of claim 19, wherein step (c) further includes:

2 (c.1) determining a Time Of Day synchronization mode used by the communication unit.

1 22. The method of claim 21, wherein step (c.1) further includes:

2 (c.1.1) joining the communication unit to an existing communication network using a
3 user configurable primary Time Of Day synchronization mode.

1 23. The method of claim 22, wherein step (c.1) further includes:

2 (c.1.2) changing the Time Of Day synchronization mode of the communication unit in
3 response to the communication unit failing to join a communication network with neighboring
4 communication units using a previously selected Time Of Day synchronization mode; and
5 (c.1.3) joining the communication unit to an existing communication network using the
6 changed Time Of Day synchronization mode.

1 24. The method of claim 23, wherein step (c.1) further includes:
2 (c.1.4) starting an isolated network with neighboring communication nodes upon failing
3 to join a communication network with previously selected Time Of Day synchronization modes.

1 25. The method of claim 19, wherein step (a) further includes:
2 (a.1) storing at least one of an identifier for a communication network to which the
3 communication unit belongs, an identifier for a neighboring communication unit, an identifier for
4 a communication network to which a neighboring communication unit belongs, and an identifier
5 for a neighboring communication unit's neighbor.

1 26. The method of claim 19, wherein step (b) further includes:
2 (b.1) determining search parameters that control the manner in which the communication
3 unit searches for neighboring communication units and neighboring communication nodes; and
4 (b.2) controlling transmission of outgoing messages and reception of incoming messages
5 in a manner consistent with search parameters determined by the search module.

1 27. The method of claim 26, wherein step (b.1) further includes:
2 (b.1.1) determining a rate at which the communication unit transmits outgoing messages
3 containing network connectivity information.

1 28. The method of claim 27, wherein said transmit rate is based upon a user
2 configurable reference transmit rate value and a percentage of network size parameter value for
3 the communication network to which the communication unit belongs.

1 29. The method of claim 28, wherein the transmit rate is proportional to the

2 percentage of network size parameter value.

1 30. The method of claim 26, wherein step (b.1) further includes:

2 (b.1.1) determining a scan window interval during which the communication unit
3 receives incoming network connectivity messages; and
4 (b.1.2) determine a delay between scan window intervals.

1 31. The method of claim 30 wherein the scan window interval is determined based
2 upon a user configurable reference scan window value and a percentage of network size
3 parameter value for the communication network to which the communication unit belongs.

1 32. The method of claim 31 wherein the scan window interval is inversely
2 proportional to the percentage of network size parameter value.

1 33. The method of claim 19, wherein step (b) further includes:

2 (b.1) determining a merge priority for each neighboring communication network in
3 response to the communication unit controlling said merging, wherein the merge priority controls
4 the priority in which the communication unit allows the communication network to which the
5 communication unit belongs to merge with neighboring communication networks.

1 34. The method of claim 33, wherein the merge priority for a neighboring
2 communication network is based upon a comparison of a number of active communication units
3 in the neighboring communication network with a number of total communication units in the
4 neighboring communication network.

1 35. The method of claim 34, wherein the merge priority is proportional to a quotient
2 of the number of active communication units and the number of total communication units for
3 each respective neighboring network.

1 36. A communication network comprising:
2 a plurality of communication units each having connectivity with a plurality of

3 neighboring communication units that belong to the same communication network, wherein one
4 of said communication units is designated a control node that is delegated authority for
5 controlling merges between the communication network and a selected neighboring
6 communication network, and wherein the control node includes:

7 a connectivity information storage module to store connectivity information related to
8 connectivity between a plurality of communication units within said network and a plurality of
9 neighboring communication units that belong to neighboring communication networks;

10 a merge module to examine the stored connectivity information and to set merge control
11 parameters that control whether a merge is initiated between a communication network to which
12 the communication unit belongs and a neighboring communication network; and

13 a controller module to control network merging in a manner consistent with merge
14 parameters determined by the merge module.

1 37. The network of claim 36 wherein said each communication unit transmits
2 messages in the form of radio signals.

1 38. The network of claim 36 wherein said merge module further includes:

2 a merge priority module to determine a merge priority parameter for a neighboring
3 communication network that determines a priority in which the communication network to which
4 the communication unit belongs allows merges with neighboring communication networks.

1 39. The network of claim 38 wherein the merge priority module determines the merge
2 priority for a neighboring communication network based upon a comparison of a count of active
3 communication units within a neighboring communication network with a count of all
4 communication units within a neighboring communication network.

1 40. The network of claim 39 wherein the merge priority is proportional to a quotient
2 of the count of active communication units and the count of all communication units for each
3 respective neighboring network.